

REMARKS

Claims 1-35 are currently pending in the subject application, and are presently under consideration. Claims 19-24 are allowed. Claims 1-3, 8-12, 16, 17, 25 and 29-34 are rejected. Claims 4-7, 13-15, 18, 26-28 and 35 have been indicated as allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 34 has been amended.

Favorable reconsideration of the application is requested in view of the amendments and comments herein.

I. Title of the Invention

The Office Action states that “a new title is required that is clearly indicative of the invention to which the claims are directed.” Applicant submits that the present title is indicative of the subject matter claimed as to comply with 37 C.F.R. 1.72. The title of the present application is “SYSTEM AND METHOD FOR CONFLICT RESPONSES IN A CACHE COHERENCY PROTOCOL WITH ORDERING POINT MIGRATION.” The claims in the present application are consistent with this title. For example, claim 1 recites:

1. A system comprising:
 - a home node that receives a first request for data from a first node according to a first cache coherency protocol and provides a second request for the data based on the first request; and
 - a second node that provides a conflict response to the second request, the conflict response indicating that an ordering point for the data is migrating according to a second cache coherency protocol, which is different from the first cache coherency protocol.

Additionally, claim 31 recites:

31. A method comprising:
 - providing a snoop request for data from a home node in response to a request for the data according to a forward progress protocol; and
 - reissuing the snoop request from the home node in response to receiving a response at the home node associated with migration of an ordering point from a cache of a first processor to a cache of a second processor.

Since the title is indicative of the subject matter being claimed, no change has been made to the title. Applicant requests that the objection to the title be withdrawn.

II. Rejection of Claims 1, 8-12, 16-17, 25, 29-34 under 35 U.S.C. 102

Claims 1, 8-12, 26-17, 25, 29-34 have been rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,877,056 to Cypher ("Cypher"). Applicant respectfully traverses this rejection for at least the following reasons.

Cypher does not anticipate claim 1. Cypher does not disclose a second node that provides a conflict response to a second request, the conflict response indicating that an ordering point for data is migrating according to a second cache coherency protocol, which is different from a first cache coherency protocol, as recited in claim 1. The Office Action contends that this element is disclosed by Cypher at Col. 18, Lines 33-63. Applicant's representative respectfully disagrees. First Cypher teaches a mode unit that determines either a point-to-point (PTP) or a broadcast mode based on the transaction that is issued (See Cypher at Col. 7, lines 25-35) or the computer system may only implement a PTP mode (See Cypher at Col. 7, lines 12-15). That is, nothing in Cypher teaches or suggests the interrelationship of first and second cache coherency protocols, as recited in claim 1.

The particular section of Cypher being relied on to reject claim 1 discloses transitioning access rights and ownership responsibilities according to a single selected coherency protocol, described in Cypher as the broadcast mode (See Cypher, Col. 18, Lines 39-41). The mode is selected. In Cypher, when an active device D2 initiates a read-to-share (RTS) in order to obtain a read access right, an active device D1 will receive an RTS packet from D2 through address network 150 (See Cypher, Col. 18, Lines 54-56). In response to the RTS packet, D1 sends a data packet including the requested data to D2, and D1 loses its write access right to the data packet, but continues to maintain ownership of a coherency unit (See Cypher, Col. 19, Lines 60-64). Additionally, the entire set of transactions being described at Col. 18, line 33, through Col. 20, line 57 (corresponding to FIGS. 12A-12F), relate to operation in the broadcast mode only.

Nothing in Cypher teaches a device that provides a conflict response, as recited in claim 1. In claim 1, the conflict response is provided by a second node to the second request (provided by the home node) and the conflict response indicates that an ordering point for data is migrating. Since Cypher fails to teach each and every element of claim 1, Cypher does not anticipate claim 1. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 1.

Claims 8-11 depend either directly or indirectly from claim 1 and are not anticipated by the cited art for at least the same reasons as claim 1, and for the specific elements recited

therein. Moreover, each of the systems of claim 8-11 recite a system that employs a conflict response and further recites an interrelationship between first and second cache coherency protocols that are not taught or suggested in Cypher. Accordingly, claims 8-11 are patentable over the cited art.

Additionally, regarding claim 11, Cypher does not disclose that each of a first and second nodes comprises a respective processor having an associated cache that comprises a plurality of cache lines, each of the first and second nodes being programmed to facilitate interaction between a first protocol and a second protocol during migration of an ordering point from the cache of the second node to the cache of the first node, as recited in claim 11. As discussed above with respect to claim 1, from which claim 11 depends, Cypher does not teach a mechanism to provide a conflict response that indicates an ordering point for data is migrating. As a consequence of Cypher's failure to disclose address migration of an ordering point, there is consequently nothing in Cypher that discloses programming the first and second nodes in the manner recited in claim 11. In particular, Cypher employs a mode unit 250 and a switch 252 to determine which mode is to be implemented for a given transaction or request. See Cypher at Col. 7, line 25, through Col. 9, line 40. Thus, the approach taught by Cypher does not provide for any interaction between the PTP mode and the broadcast mode during migration of an ordering point, as recited in claim 11. Moreover, Cypher also fails to teach that an ordering point can migrate from cache of one node to cache of another node, such that there would be no basis to further conclude that any nodes in the system of Cypher would be programmed as set forth in claim 11. For these reasons, Applicant respectfully requests reconsideration and allowance of claim 11..

Cypher does not anticipate claim 12. Cypher does not disclose a home node, as recited in claim 12. In rejecting claim 12, the Office Action contends that Cypher, Col. 10, lines 37-62, discloses the elements of claim 12 (See Office Action, Page 3). Applicant's representative respectfully disagrees. Cypher discloses that upon receiving a request for a particular coherency unit at a memory subsystem 144, a controller 210 may determine from directory 220 that a particular client has a copy of the requested data (See Cypher, Col. 10, lines 45-49). Cypher also discloses that the controller 210 then conveys a message to that particular client that indicates the particular coherency unit has been requested (See Cypher, Col. 10, Lines 49-51).

In contrast, claim 12 recites that the home node reissues at least one snoop when another copy of line of data exists in a system associated with a broadcast-base protocol and

no copy of the line of data is returned in response to the request provided by a first processor. That is, the home node recited in claim 12 can reissue the snoop for the line of data when there is another copy of the line of data in the system associated with a broadcast-based protocol two copies of a line of data in a system (the copy and the another copy). Nothing in Cypher discloses that a home node reissues at least one snoop, as recited in claim 12. This deficiency in Cypher is due, at least in part, to the Cypher's failure to teach or suggest that the interrelationship between the forward progress protocol and the broadcast-based protocol in a multi-processor computer system, as recited in claim 12. Therefore, Cypher does not disclose each and every element of claim 12. Accordingly, Cypher does not anticipate claim 12, and claim 12 should be patentable over the cited art.

Claim 17 depends from claim 12 and is not anticipated by Cypher for at least the same reasons as claim 12, and for the specific elements recited therein. Accordingly, claim 17 should be patentable over the cited art.

Cypher does not anticipate claim 25. Cypher fails to teach or disclose any structure that can provide for transitioning a cache state for data at a first processor node from an ownership state to a transition state associated with migration of an ordering point for the data from the first processor node in response to a request for the data according to a first cache coherency protocol, as recited in claim 25. Instead, Cypher discloses use of various cache states, while they may be difference from a conventional MOSI protocol, none of which corresponds to the transition in cache states (from ownership state to a transition state) recited in claim 25. Additionally, Cypher fails to teach any structure that provides for issuing a first snoop from a home node according to a second cache coherency protocol that is different from a first cache coherency protocol. Again, similar to as discussed above, Cypher does not teach or suggest the interaction or interrelationship between different cache coherency protocols that are implemented in the system of Claim 25. This proposition becomes more evident in view of Cypher's failure to teach or suggest any structure that would issue a second snoop from the home node to request the data from at least the first processor node (which can transition from the ownership state to a transitions state), which second snoop is issued from the home node in response to setting a conflict condition at the home node based on responses to the first snoop at the home node. To contend that the same rationale to reject claim 25 and claim 1, as is done in the Office Action, amounts to a failure to properly examine claim 25 and, therefore, fails to establish a prima facie case of unpatentability. Since Cypher does not disclose each and every element of claim 25, Cypher

does not anticipate claim 25. Reconsideration and allowance of claim 25 are respectfully requested.

Claim 30 depends from claim 25 and is not anticipated by Cypher for at least the same reasons as claim 25, and for the specific elements recited therein. Accordingly, claim 30 is also patentable.

Regarding claim 31, Cypher fails to teach reissuing a snoop request from a home node in response to receiving a response at the home node associated with migration of an ordering point from a cache of a first processor to a cache of a second processor, as recited in claim 31. Similar to as discussed above with respect to claims 11 and 12, Cypher fails to teach that an ordering point can migrate from cache of one node to cache of another node migration of an ordering point for data. Since Cypher fails to teach such ordering point migration, there is consequently no further teaching in Cypher that a response would be received at the home node associated with migration of an ordering point from a cache of a first processor to a cache of a second processor, as recited in claim 31, which would result in the snoop request from the home node being reissued. The particular directory-based coherency protocol described in Cypher at Col. 10, lines 36-61, fails to teach or suggest that the memory subsystem would reissue a snoop request under any conditions, especially not in response to the conditions recited in claim 31. Applicant respectfully requests reconsideration and allowance of claim 31.

Claims 32-34 depend either directly or indirectly from claim 31, and are not anticipated by the cited art for at least the same reasons as claim 31, and for the specific elements recited therein. Accordingly, claims 32-34 are patentable over the cited art.

Additionally, regarding claim 32, similar to as discussed with respect to claim 11, Cypher fails to teach or suggest the interrelationship of first and second cache coherency protocols. Consequently, Cypher likewise fails to provide any teaching or suggestion that the ordering point migration (recited in claim 31) would occur in response to a source broadcast request from the second processor to the first processor for the data. Such an interrelationship between a forward progress protocol and a broadcast-based protocol (as recited in claim 32) is not contemplated by the teachings of Cypher. See Cypher at Col. 7, line 25, through Col. 9, line 40. Reconsideration and allowance of claim 32 are respectfully requested.

Claim 33 is patentable over Cypher for reasons similar to those discussed above with respect to claim 25. For example, Cypher fails to teach or disclose transitioning a state

associated with data at a first processor from an owner state to a transition state associated with migration of the ordering point (recited in claim 31). The cited section of Cypher, beginning at Col. 14, line 50 of Cypher, describes general properties of the coherence protocol implemented by the computer system 140 (corresponding to W, A, R and T access rights), but fails to include any functionality that corresponds to the transitioning of state from an owner state to a transition state, as recited in claim 33. Additionally, while Cypher discloses that the ownership responsibilities may change in the BC mode (See Cypher at Col. 18, line 32, through Col. 20, line 56), Cypher provide no teaching or suggestion that a state associated with data at a processor (that provides an ownership data response) would transition from an ownership state to a transitions state, as recited in claim 33. Instead, Cypher teaches that the D1 sends corresponding data packet to D2, D1 loses its W access right and changes its right to an I (invalid) access right. Since Cypher fails to teach or suggest the method of claim 33, Applicant respectfully requests reconsideration and allowance of claim 33.

Claim 34 has been amended to correct a typographical error. Cypher does not disclose transitioning a state associated with data at a second processor that provided a source broadcast request for the data in response to an ownership data response, the second state defining a second processor as a new cache ordering point, as recited in claim 34. Cypher discloses that changes in ownership status occur in response to a reception of address packets and that receiving data packets do not affect the ownership status (See Cypher, Col. 14, Lines 53-56). This is further described at Col. 19, lines 11-13, of Cypher in which D2 changes its ownership status to O (owned) when D2 receives its own RTO (read to own) transaction via address network 150. Since Cypher does not disclose each and every element of claim 34, reconsideration and allowance of claim 34 are respectfully requested.

III. Rejection of Claims 2-3 under 35 U.S.C. 103

Claims 2-3 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Cypher in view U.S. Patent No. 6,883,070 to Martin et al. ("Martin"). Applicant respectfully traverses this rejection for at least the following reasons.

Claims 2 and 3 depend from claim 1. The addition of Martin does not cure the aforementioned deficiencies of Cypher with respect to claim 1, from which claims 2 and 3 depend. Accordingly, claims 2 and 3 are not obvious, and are patentable over the cited art.

Additionally, in rejecting claim 2, the Office Action admits that Cypher does not teach or suggest a home node that provides a retry request associated with a second request for data in response to a conflict response from a second node. The Office Action contends that Martin, particularly Col. 8, Lines 26-30 of Martin, cure the deficiencies of Cypher. Applicant respectfully disagrees. The cited section of Martin teaches that if a block 19 of a dual-cast request is not owned by a memory controller 11, a retry number is initialized to zero and the memory controller proceeds to check to see if a message can be injecting on an ordered request network 28 (See Martin, Col. 8, Lines 26-50). Claim 2 recites that a home node provides a retry request in response to a conflict response, which as recited in claim 1, indicates that an ordering point is migrating according to a second cache coherency protocol. In contrast to claim 2, Martin teaches that a request is generated based upon a lack of ownership by the memory controller, with the request being handled slightly differently depending on the type of request (i.e., broadcast request, dual-cast request or multi-cast request). See Martin at Col. 8, lines 12-47. Because Martin fails to teach or suggest that a retry is provided by a home node in response to a conflict response, as recited in claim 2, reconsideration and allowance of claim 2 are respectfully requested.

Claim 3 recites that in response to the retry request associated with the second request (from claim 2), the home node and first node each receives a response that includes a copy of the data to complete the request for the data from the first node. Respectfully, Martin does not teach that a home node and a first node each receives a response that includes a copy of the data in response to the retry request. Instead, Martin teaches that shared memory replies with data when a dual-cast, not a broadcast request, to a memory controller which determines if the shared memory owns the requested block of memory. See Martin at Col. 8, lines 25-47. Respectfully, it would not be obvious to a person of ordinary skill in the art at the time of the invention to provide the system of claim 3 based on the combined teachings of Cypher and Martin according to which the home node receives a first request for the data. Applicant respectfully requests reconsideration and allowance of claim 3.

IV. Allowable Subject Matter

Applicant appreciates the indication that claims 19-24 have been allowed and that claims 4-7, 13-15, 18, 26-28 and 35 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Applicant respectfully requests that the objection to claims 4-7, 13-15, 18, 26-28 and 35 be withdrawn in view of the

above comments distinguishing the respective independent and intervening claims from which these objected claims depend.


V. CONCLUSION

In view of the foregoing remarks, Applicant's representative respectfully submits that the present application is in condition for allowance. Applicant's representative respectfully requests reconsideration of this application and that the application be passed to issue.

Should the Examiner have any questions concerning this paper, the Examiner is invited and encouraged to contact Applicant's undersigned attorney at (216) 621-2234, Ext. 106.

No additional fees should be due for this response. In the event any fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to Deposit Account No. 08-2025.

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